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A NEW GENUS AND TWO NEW SPECIES OF
SPHAEROMATID ISOPODS FROM THE
HIGH INTERTIDAL ZONE AT
NAOS ISLAND, PANAMA

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The three new species of sphaeromatid isopods described in this paper were found living together, in association with a large barnacle in the high intertidal zone, at Naos Island on the Pacific shore of Panamá (79°32'08''W; 8°54'57''N). Two of the species can be placed readily in the genus *Dynamenella* of the Eubranchiatae. The relationship of the third form is not so clear-cut; it has been described here as a new genus and species in the platybranchiate group. A search for members of the Sphaeromatidae was undertaken in this area in connection with previous studies of shore forms, especially symbiotic species, in tropical Atlantic waters (Menzies and Glynn in press; Glynn, in press). Appreciation is expressed for the opportunity provided by I. Rubinoff and I. E. Wallen, Smithsonian Institution, to initiate these studies on the Panamanian isopod fauna. Critical comments offered by R. J. Menzies (Florida State University) and T. E. Bowman (Smithsonian Institution) helped to improve the manuscript; their remarks are also gratefully acknowledged.

Formalin washings of cobbles and boulders, and other likely retreats (small and sparse patches of encrusting algae; *Chiton stokesii* Broderip, 1832, the only large intertidal chiton; oyster shells, both living and dead of the two species *Ostrea iridescens* Hanley, 1854 and *O. conchaphila* Carpenter, 1856; the large pulmonate *Siphonaria gigas* Sowerby, 1825) were obtained systematically at all horizons in the intertidal belt over the

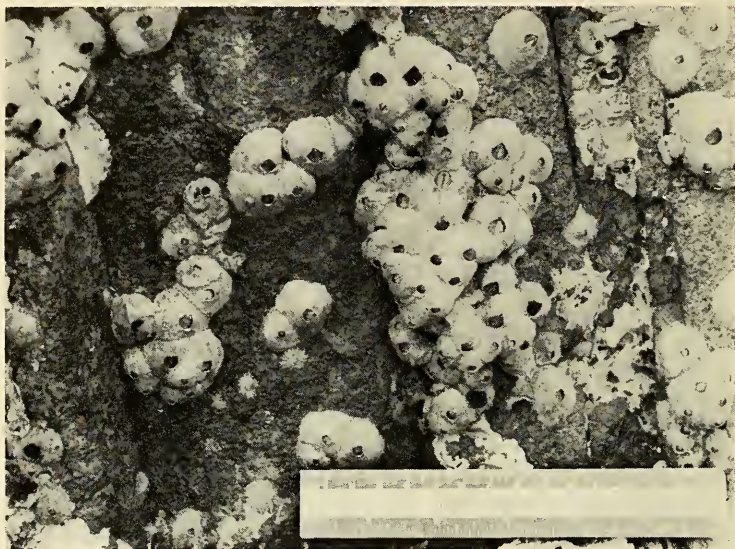


FIG. 1. Type-locality at Naos Island, Panamá (2 April 1968). The vertical rock face is dominated by clusters of both living and dead *Tetracita squamosa panamensis*. The substratum is fine grained, igneous rock (dacite).

period January 18–23, 1967. At that time numerous isopods were found only with the abundant and large sessile cirriped *Tetracita squamosa panamensis* Pilsbry, 1916 on the upper shore near and above mean sea level (Fig. 1). (More recently one species of *Dynamenella* was collected from dense growths of the barnacle *Chthamalus*). The sites occupied on *Tetracita*, at low water when the collections were made, were the spaces between the basal plate and substratum, the parietal canals within the parapet and inside dead, empty tests, peripherally where the parapet joins the basis. These various niches also provide refuge for an overlapping micro-fauna composed of elements from the upper and lower reaches of the tide. Included in this assemblage are juvenile gastropods, *Onchidella*, *Lasaea*, sipunculids, anemones, mites, the springtail *Anurida maritima*, pseudoscorpions, etc. Although hundreds of individuals of the three species of isopods were found inhabiting less than 20 barnacles growing in juxtaposition, attempts to collect

the isopods from several other barnacle clusters in the same vicinity were without success.

The factors responsible for the patchy occurrence of the isopods, their interspecific interactions, and the symbiotic relations with the barnacle host, are questions which immediately come to mind. These animals may provide good material for the investigation of such problems.

FAMILY SPHAEROMATIDAE DAHL, 1916

Cephalon with well developed epistome, not divided into frontal plate and clypeus, and rarely fused with upper surface of cephalon. Peduncle of Ant¹ (first antennae) three-jointed, of Ant² five-jointed. Mouth parts biting or gnawing, never really suctorial; second joint of maxillipeds at least in males and immature specimens without external expansion; mouth parts in females with brood rather frequently strongly metamorphosed and useless for nutrition. Peraeon with seven somites, all free; marsupial lamellae only on second, third and fourth "epimera", rarely wanting. The brood develops in pouches and not out free in the marsupium. All pleopods (Plp) lamellar; all endopods, and at least exopods of Plp¹ and Plp² unjointed; at least both rami of Plp¹ and Plp² fringed with long plumose setae; both rami of Plp⁴ and Plp⁵ (or endopod of Plp⁴ and Plp⁵) without such setae, but adapted for a respiratory function. Pleon and pleotelson combine functionally to form a vault in which the pleopods are enclosed. Uropods with rami unjointed, these, at least in females, generally depressed, sometimes one or even both wanting. Body can be rolled more or less completely into a ball (slightly modified from Hansen, 1905).

GROUP EUBRANCHIATAE

Plp⁴ and Plp⁵ have both rami subsimilar, with deep, essentially transverse folds, often of fleshy aspect, without PMS (plumose marginal setae); exopod of Plp⁵ generally distinctly two-jointed, with the sub-apical squamiferous protuberance on lower surface very high. Plp³ have both rami closely set with long PMS at least on distal margin. Endopod of Plp¹ at least rather broad, scarcely ever half as long again as broad. End of pleotelson at least emarginate, generally with notch or with a slit terminating in a foramen (Hansen, 1905).

Genus *Dynamenella* Hansen, 1905

Type-species.—*Dynamenella perforata* (Moore, 1901).

Diagnosis: Both sexes rather similar in aspect, without real processes; abdomen with notch which is semicircular or oblong in female, in male narrow in distal part, while proximal part constitutes a transverse foramen; uropods subsimilar in both sexes, with rami lamellar. Mouth-

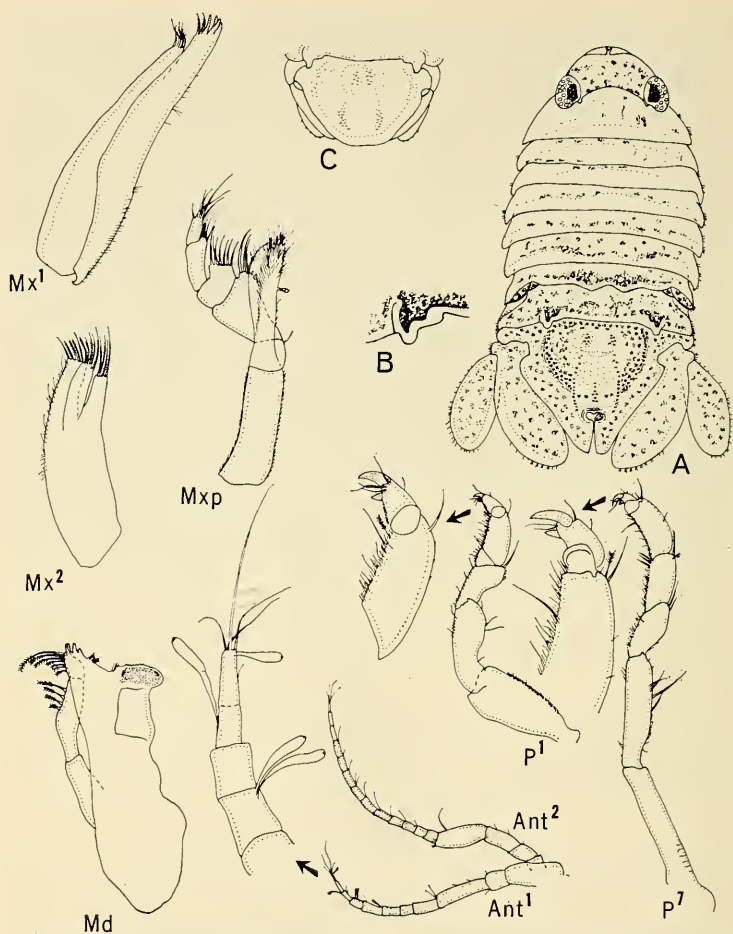


FIG. 2. *Dynamenella josephi* new species; A. male holotype, length 3.2 mm; B. enlarged view of pleonal suture; C. pleotelson of female allotype, length 2.5 mm; P^7 , seventh peraeopod and enlarged view of apical segments; P^1 , first peraeopod and enlarged view of apical segments; Ant^1 , first antenna and enlarged view of apical segments; Ant^2 , second antenna; Md, mandible and mandibular palp; Mx^2 , second maxilla; Mxp, maxilliped; Mx^1 , first maxilla.

parts similar in both sexes; male with appendix masculinum on endopod of Plp^2 ; marsupial lamellae overlap each other somewhat. Hansen also noted, but incorrectly, that exopod of Plp^3 is unjointed and basal joint of Ant^1 is of usual shape, not expanded in a free plate.

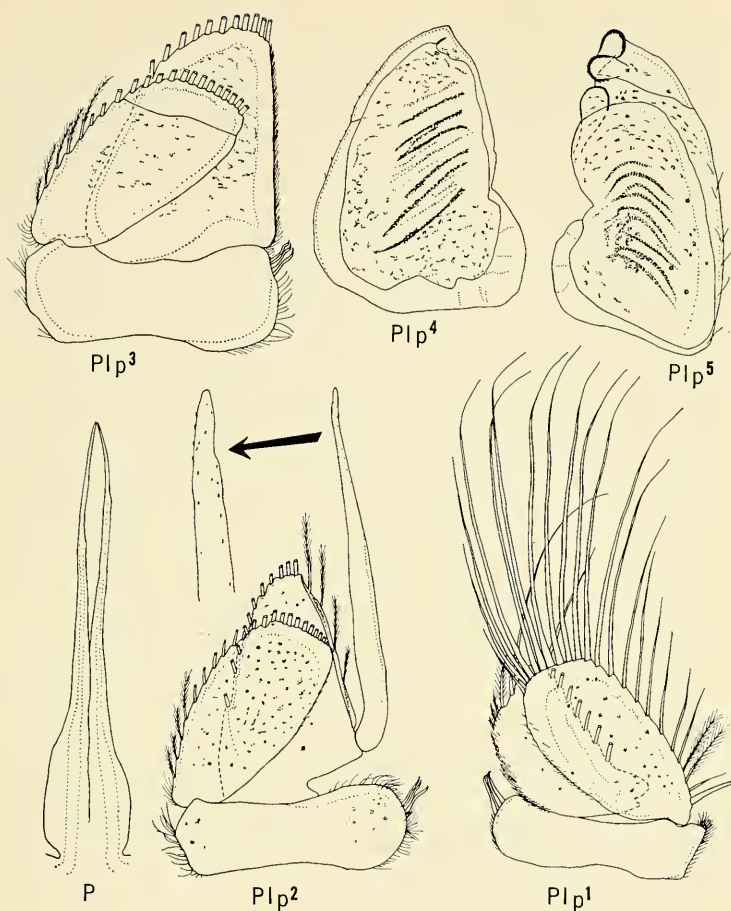


FIG. 3. *Dynamenella josephi* new species; Plp¹, first pleopod; Plp², second pleopod and stylet with enlarged view of tip; P, penes; Plp³, third pleopod; Plp⁴, fourth pleopod; Plp⁵, fifth pleopod.

Remarks: The subsequent description of several species of *Dynamenella* has somewhat modified Hansen's original concept of the genus. For example, the pleotelson in males of *D. tropica* (Loyola e Silva, 1960), *D. acutitelson* and *D. barnardi* (Menzies and Glynn, in press) is provided with just a simple indentation, lacking a transverse foramen. Further, the female of *D. acutitelson* var. *glabrothorax* is without any notch on the pleotelson, but rather has the terminal border drawn out as a blunt spine. Typically the exopod of Plp³ is jointed.

***Dynamenella josephi* new species**

Figures 2 and 3

Diagnosis: Sexes dimorphic in pleotelson; mature male with slit and transverse foramen on posterior border of pleotelson; female with smooth, ovate border or at most with faintly perceptible indentation. First pleonal somite in both sexes with a pair of excrescences near midline; anterior border of pleotelson with two small pairs of tuberculate ridges; rear half of pleotelson with single pair of elongate, tuberculate ridges lateral to midline. These ridges are smooth and rounded in female, but more irregular and ragged in male. Tuberculate carina on midline of pleotelson, extending forward about half its length. Pleonal suture with a single, forwardly directed incision. This incision flexes medially near anterior termination. Male with a pair of circular, pigment-free spots near midline on seventh peraeonal somite. Both rami of Plp¹-Plp³ with PMS. Exopod of Plp³ jointed. Plp⁴ and Plp⁵ with both rami membranous and provided with conspicuous transverse folds. Exopod of Plp⁴ with cleft on upper, lateral margin; endopod with apical spine. Exopod of Plp⁵ jointed; three prominent, squamiferous protuberances with one apical member bluntly spinose. Stylet nearly twice length of endopod of Plp². Penes long, one and one-half times the length of Plp²; and tenuiform.

Measurements: Male holotype, length 3.2 mm, width 1.4 mm. Female allotype (illustrated), length 2.5 mm, width 1.2 mm.

Type-locality: Naos Island, Panamá, 22 January 1967; holotype (USNM 122850), plus 27 males, 35 females, 307 young paratypes (USNM 122851).

Distribution: Type-locality and 12 specimens from Tortola Island, Panamá (halfway between Taboga Island and the Palo Seco leper colony on the mainland), 25 September 1967, upper intertidal zone from under *Tetracita squamosa panamensis*; 35 specimens from Périco Island, Panamá, collected from under cluster of *Chthamalus* sp. in the upper intertidal zone, 30 March 1968.

Supplementary descriptive notes: Surface of body covered with minute granulations which are especially evident on the pleon of large males. Body sparsely setose. Second through seventh peraeonal somites subequal in size; first peraeonal somite nearly twice the length of second and tapering in width toward cephalon which is slightly over half the width of mid-peraeonal somites. Eyes large, occupying postero-lateral angles of cephalon. Posterior border of seventh peraeonal somite with flange on either side of midline. Central portion of pleotelson inflated in both sexes, forming a conspicuous, hemispherical elevation. Posterior border of the pleotelson in small males (ca. 1.8 mm and less) bears an incipient cleft only. Larger males, of around 2.3 mm in length and greater, have both a cleft and foramen. The development of the mature pleotelson is very similar to that in *Dynamenella perforata* (Moore, 1901; Glynn, in press). Pleonal suture similar in both sexes.

Female without pair of circular, pigment-free spots on seventh pereopod somite. Uropods broad in mature male, with relatively smooth border; exopods reach posterior border of pleotelson and endopods extend noticeably beyond this. Female uropods smaller, not quite reaching to posterior edge of pleotelson. Second, third and fourth articles of Mxp (maxilliped) palp slightly expanded; endite with a single coupling hook. Mx^1 (first maxilla) exite with four teeth. Mx^2 (second maxilla) and Md (mandible) also typical for genus, as illustrated. Female with equally well developed mouth parts. Ant¹ slightly shorter than Ant². Flagellum of Ant¹ with eight articles and five aesthetascs apically; flagellum of Ant² with 13 articles. P¹ (first pereopod) shortest, about one-half the length of P⁷. Blood sinuses very evident on rami of all pleopods. Exopod of Plp¹ with 22 PMS and a single, simple, blunt spine near base; endopod with 16 large and two small PMS, medial border of endopod with numerous short setae. Exopod of Plp² with 22 PMS; endopod with 15 PMS, four located medially along groove in which stylet rests. Stylet smooth and tapering except for scattered, minute spines terminally. Exopod of Plp³ jointed near terminal border and with 21 PMS; endopod with 11 PMS and medial border with minute setae along entire length. Exopod of Plp⁴ with seven prominent respiratory folds and lateral margin provided with few, minute setae; endopod with four well developed respiratory folds. Respiratory folds six in number on two-jointed exopod of Plp⁵, lateral border of exopod sparsely setose; individual folds not readily discernible but apparently eight in number and best developed on endopod.

Affinities: *Dynamenella josephi* shows a very close resemblance to *D. perforata* (Moore, 1901; Menzies and Glynn, in press) and *D. antonii* (Loyola e Silva, 1960). The mature males of the three species are very similar in appearance. However, whereas *D. perforata* and *D. antonii* have pleonal sutures with two incisions, *D. josephi* can be readily distinguished by a simpler suture of only one incision. The dimorphic character of the pleotelson in the two sexes, and the development of the slit and foramen in males of *D. perforata* and *D. josephi*, follow essentially the same pattern. The pleopods are likewise strikingly similar in these species. The stylet is long and tapering, the exopod of Plp³ is jointed marginally, the endopod of Plp⁴ has an apical spine, and the exopod of Plp⁵ bears three prominent, squamiferous protuberances and is jointed marginally. Finally, the penis is long, filiform and bifurcated to the base.

The deficient description of *Clianeella elegans* Boone, apparently a closely related form, does not permit an entirely critical comparison with *D. josephi*. The following relevant characters at least indicate that the two species are distinct: basal articles of Ant¹ swollen; frontal margin of cephalon carinate and sculptured; foramen in pleotelson surrounds an overhanging, blunt, round, tooth-like projection (Boone, 1923).

Etymology: *josephi*, from the middle name of my son, who at an early age preferred to "experiment" with *Dynamenella perforata* rather than play with toys.

***Dynamenella setosa* new species**

Figures 4, 5 and 6

Diagnosis: No obvious difference in the appearance of the two sexes. Body covered with dense growth of long setae. Posterior border of pleotelson denticulate and with a narrow slit communicating with circular foramen. Central portion of pleotelson inflated. Pleonal suture with a long incision leading forward for about half its length then flexing medially; a second, shorter incision joins main cleft at point of flexure. Uropods large, serrate and extend well beyond posterior border of pleotelson. Both rami of Plp¹-Plp³ with PMS. Exopod of Plp³ jointed. Both rami of Plp⁴ and Plp⁵ membranous and provided with deep-set, transverse folds. Exopod of Plp⁵ jointed; one squamiferous protuberance located laterally and two apically. Stylet long and tapering, nearly twice the length of endopod of Plp² (paratype specimen). Penis bifurcate to base, long (exceeding length of Plp²) and tenuiform.

Measurements: Male holotype, length 3.1 mm, width 1.5 mm. Female allotype (illustrated), length 2.9 mm, width 1.5 mm.

Type-locality: Naos Island, Panamá, 22 January 1967; holotype (USNM 122854) plus 1 male and 14 female paratypes (USNM 122855).

Distribution: Type-locality and 35 specimens from Tortola Island, Panamá, 25 September 1967. Hypotypes also associated with *Tetraclita squamosa panamensis* in the upper intertidal zone.

Supplementary descriptive notes: Cephalon, peraeonal somites five through seven, and pleon amply provided with minute tubercles and their associated setae. Peraeonal somites two through seven subequal in size; first somite twice the length of second. Cephalon and first peraeonal somite equal in length. Eyes large, located at postero-lateral angles of cephalon. Central, anterior margin of pleotelson depressed in both sexes. The extent of development of the penes and stylet in the holotype indicates that this specimen was not fully mature. Larger male paratype (broken in half), with major features of pleotelson developed to same extent as in holotype, does however show minor differences in posterior half of body which should be noted. These differences include a pair of circular, pigment-free spots near midline on posterior border of seventh peraeonal somite (large females lack these); upward extension of posterior margin of seventh peraeonal somite as flange; a pair of ragged, spinous projections near midline of first pleonal somite; two pairs of similar projections in line with above on pleotelson. A hyaline rim is formed around foramen in pleotelson in large individuals of both sexes. Mxp palp with second, third and fourth articles slightly expanded; endite with a single coupling hook and two rows of teeth (three in each). Mx¹ exite with five teeth and three setae, endite with

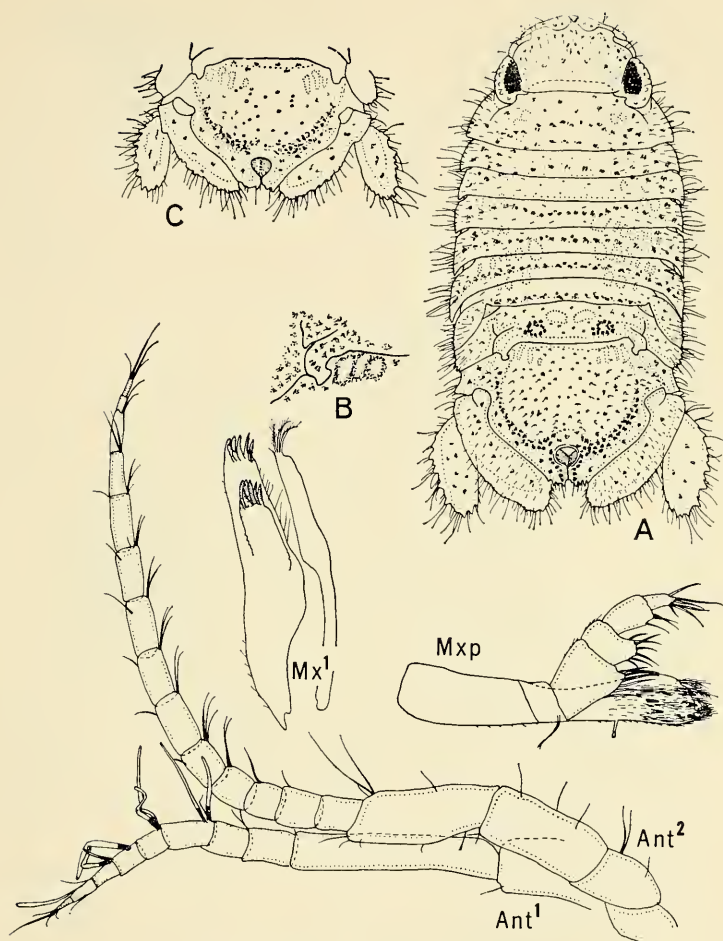


FIG. 4. *Dynamenella setosa* new species; A. male holotype, length 3.1 mm; B. enlarged view of pleonal suture; C. pleotelson of female allotype, length 2.9 mm; Mxp, maxilliped; Ant¹, first antenna; Ant², second antenna; Mx¹, first maxilla (near moult).

three setae. Mx² normal for genus. Md normal, with incisor heavily armed with teeth and well developed molar. Females also with well developed mouth parts. Ant¹ about two-thirds the length of Ant². Flagellum of Ant¹ with nine articles and eight aesthetascs terminally. Ant² with 14 articles in the flagellum. P¹ comparatively short and stout,

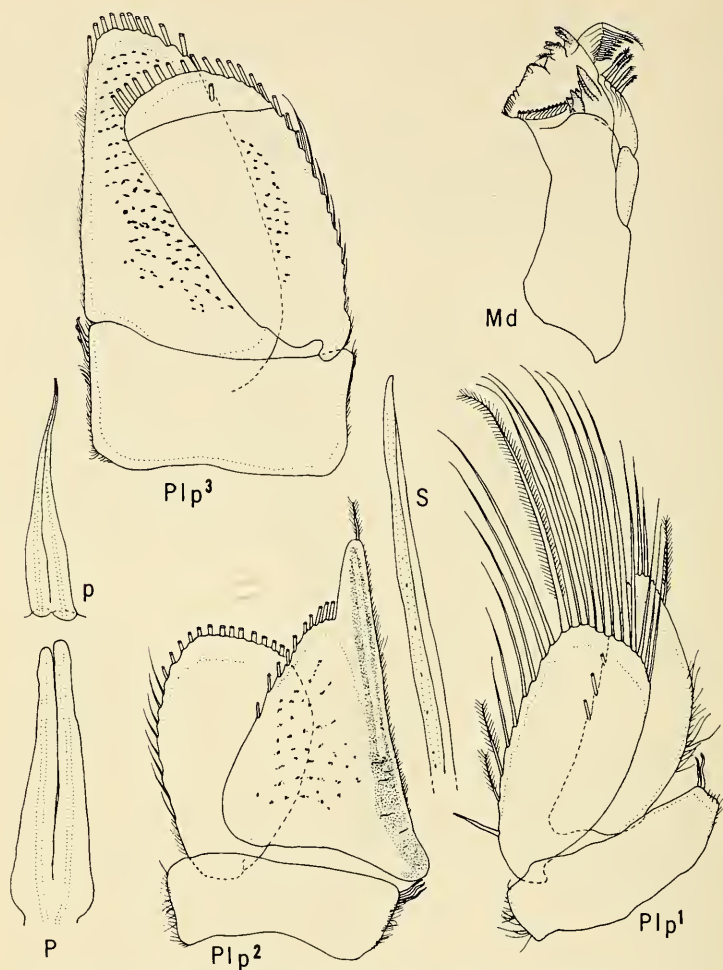


FIG. 5. *Dynamenella setosa* new species; Plp^1 , first pleopod; Plp^2 , second pleopod with incompletely formed stylet; S , fully formed stylet from paratype specimen; P , penes; p , penes from paratype specimen shown at lower magnification; Plp^3 , third pleopod; Md , mandible and mandibular palp (near moulting).

rear peraeopods longer and more slender. Blood sinuses conspicuous over surface of all pleopods. Plp^1 exopod with 20 PMS plus one simple, short spine; endopod with 13 PMS. Plp^2 exopod with 23 PMS; endopod with 10 PMS and incompletely formed stylet (holotype). Fully mature stylet appears to possess one beveled edge. Exopod of Plp^3 jointed and

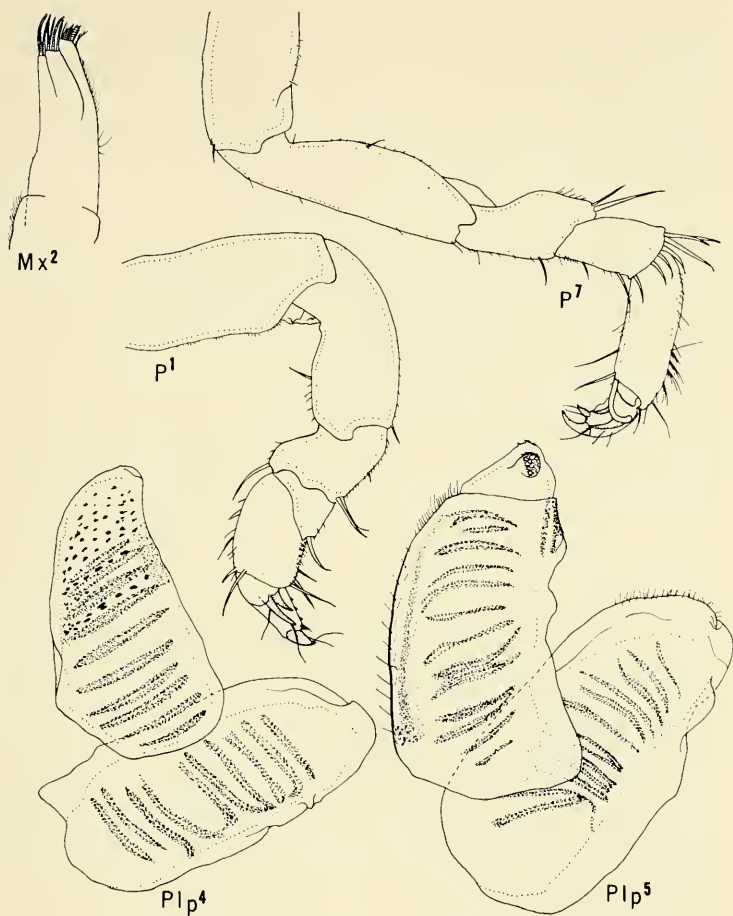


FIG. 6. *Dynamenella setosa* new species; Plp⁵, fifth pleopod; Plp⁴, fourth pleopod; Mx², second maxilla; P¹, first pereopod; P⁷, seventh pereopod.

with 27 PMS; endopod with 11 PMS. Both rami of Plp⁴ with five pairs of respiratory folds. Both rami of Plp⁵ with six pairs of respiratory folds. Lateral border of exopod of Plp⁵ sparsely setose; minute, squarish scales with marginal spines shield surfaces of squamiferous areas.

Affinities: *Dynamenella eatoni* (Miers), like *D. setosa*, also has the pleotelson of both sexes nearly identical. Even though this condition is unlike that in the type-species of the genus (*D. perforata*), Menzies (1962) and Hansen (1905) decided to retain this species in *Dynamenella*.

The pleonal suture in *D. setosa*, with two distinct incisions, is more complex than in *D. josephi*. In this respect *D. setosa* is structurally similar to *D. diana* (Menzies) where the main, forwardly directed incision appears to branch.

Etymology: *setosa*, from *saetosus* (L.), named for the conspicuous, long setae covering the dorsum.

GROUP PLATYBRANCHIATAE

Plp⁴ and Plp⁵ have both rami completely without transverse folds, and their exopods are unjointed; endopod of Plp⁴ at most with a few short terminal plumose setae, exopod of same pair rarely with numerous long marginal plumose setae (*Tecticeps*), in most genera both rami without plumose setae; both rami of Plp⁵ without plumose marginal setae, and the exopod has the squamiferous protuberances slightly in relief and in rare cases without spines or even wanting. Plp⁵ have sometimes plumose marginal setae on both rami as Plp², sometimes with endopod nearly naked or with both rami naked. Endopod of Plp¹ rarely broad, most frequently narrow. (End of abdomen sometimes with a rounded notch, often truncate, rounded, or acute.) (Hansen, 1905).

SECTION CASSIDININI

Body much or exceedingly depressed; thorax considerably or strongly expanded; margin of thorax, anterior part of abdomen, uropods and sometimes the two proximal joints of Ant¹ constituting a nearly continuous border ciliated with a more or less conspicuous rim of short protruding setae. Eyes well developed. Two proximal joints of Ant¹ with anterior part protruding, visible from above in at least almost whole length, frequently much expanded in front, depressed. Mandibles with masticatory process well developed. Anterior pairs of legs without prehensile band. Endopod of Plp¹ at least somewhat longer than broad, sometimes very narrow. Both rami of Plp³ with several plumose setae on terminal margin; exopod unjointed or two-jointed. Both rami of Plp⁴ and Plp⁵ without setae, subsimilar in aspect, respiratory. Posterior margin of abdomen short; a real notch always wanting. Marsupial lamellae wanting; brood in a chamber formed by two external pouches. (Hansen, 1905).

Striella new genus

Type-species: *Striella balani*, new genus, new species.

Diagnosis: Intermediate species with characters about equally divided between the hemibranchiate and platybranchiate groups. Body oval, strongly depressed and fringed with dense, setose growth. Cephalon confluent with and immersed in first and largest of peraeonal somites. No obvious sexual differences. Pleotelson terminates posteriorly in blunt point; minute incision faintly visible terminally. Outer rami of uropods about two-thirds length of endopods. Ant¹ roughly two-thirds

the length of Ant². Proximal joints of Ant¹ not inflated or readily visible in dorsal view. Neither does epistome protrude beyond cephalon. Lobes of Mxp palp not produced on inner margin. Md with strongly developed molar process and elongate, toothed incisor. P¹–P⁷ with natatory setae. Plp¹ endopod extremely elongate, about three times longer than wide. Appendix masculinum on Plp² inflated and projecting slightly beyond upper margin of endopod. All pleopods unjointed, and Plp⁴ and Plp⁵ without transverse, respiratory folds. Penis long, tenuiform and bifurcate to base.

Etymology: *Striella*, gender feminine, derived from combining the initials of the Smithsonian Tropical Research Institute, behind whose marine facility these animals were first collected.

***Striella balani* new species**

Figures 7, 8 and 9

Diagnosis: Cephalon and first peraeonal somite equal in length. Pleotelson essentially smooth with slightly raised, hemispherical area at midline near forward border. Pleonal suture with two short incisions which converge posteriorly. Marginal setose fringe around body best developed in larger individuals. Flagellum of Ant¹ with eight articles and five aesthetascs; flagellum of Ant² with 14 articles (illustrated left Ant² had seven terminal articles broken off; flagellum of right Ant² is composed of 14 articles). Mouth parts very similar to those in *Cassidinidea* Hansen and *Dies* Barnard (possibly a synonym of *Cassidinidea* according to Menzies and Frankenberg, 1966), i.e. second, third and fourth articles of Mxp palp not lobed, and Md with strongly formed incisor and molar process. Plp¹–Plp³ with PMS; only two coupling setae on medial margin of basis. Plp¹ exopod with 21 PMS and one spine; narrow endopod with 13 PMS. Plp² exopod with 22 PMS; endopod with 19 PMS, five aligned medially adjacent to stylet. Lateral border of stylet hyaloid above and thickened below; minute spines in couplets along medial border. Plp³ exopod with 23 PMS; endopod with 10 PMS. Plp⁴ and Plp⁵ unjointed, without setae or respiratory folds, but with conspicuous blood sinuses. A pair of creases extend across base of exopod of Plp⁴; endopod with an apical spine. Plp⁵ exopod with three squamiferous protuberances, each with a delicate pattern of striae; upper pair of protuberances capped with minute, horny spines.

Measurements: Male holotype, length 2.6 mm, width 1.8 mm. Female allotype (illustrated), length 2.1 mm, width 1.1 mm.

Type-locality: Naos Island, Panamá, 22 January 1967; holotype (USNM 122857) plus 37 males, 34 females, 42 young paratypes, USNM 122858.

Distribution: Known only from type-locality.

Affinities: Certain difficulties are met in trying to assign this species to the present system of classification. In many respects it is similar to *Exosphaeroma* and *Pseudosphaeroma* of the hemibranchiate group.

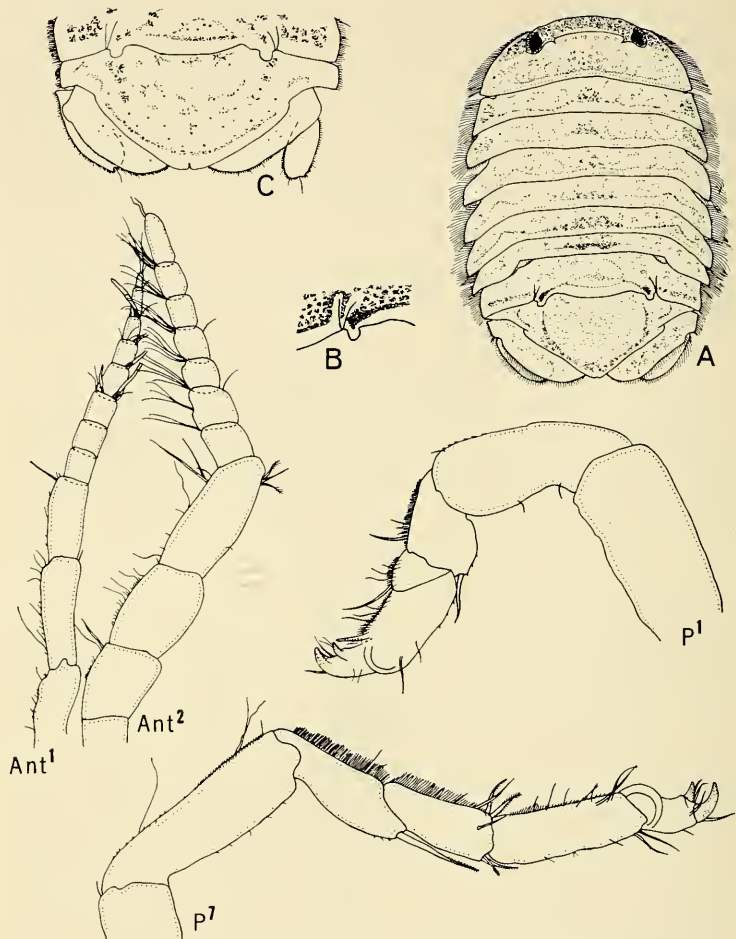


FIG. 7. *Striella balani* new genus, new species; A. male holotype, length 2.6 mm; B. enlarged view of pleonal suture; C. pleotelson of female allotype, length 2.1 mm; P¹, first pereopod; P⁷, seventh pereopod; Ant¹, first antenna; Ant², second antenna (terminal section of seven articles missing).

Several of the characters already described, however, including absence of branchiae on Plp⁴ and Plp⁵, and the unjointed exopods of these pleopods, necessitates placement of *Striella* with the Platybranchiatae.

Although the respiratory folds in *Exosphaeroma alba* are especially weakly developed in this genus, examination of the pleopods in toptype

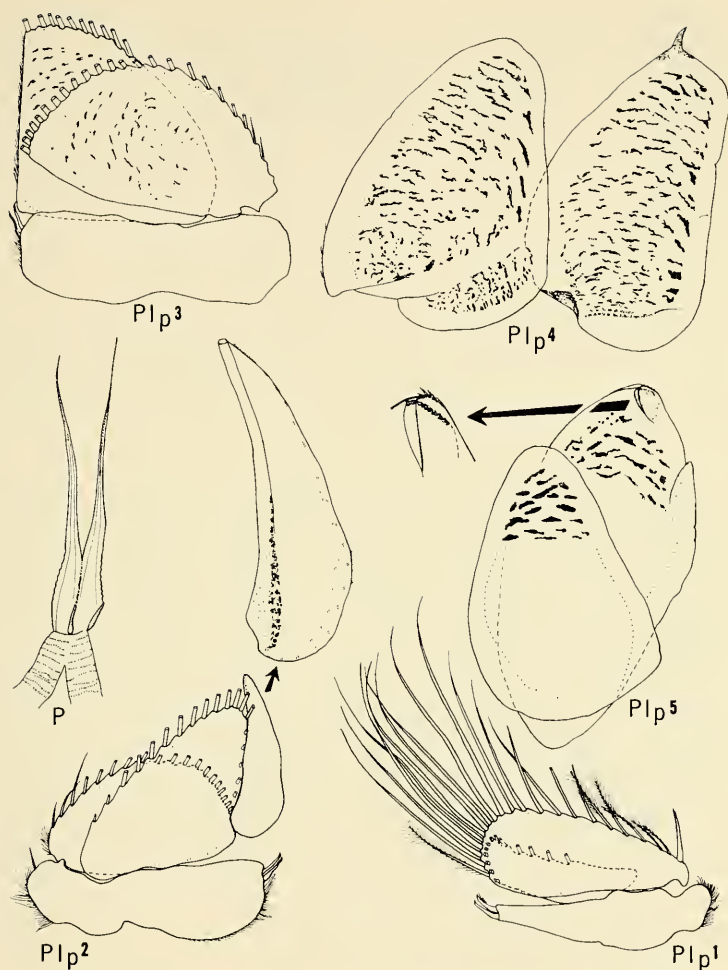


FIG. 8. *Striella balani* new genus, new species; Plp¹, first pleopod; Plp², second pleopod and enlarged view of stylet; P, penes; Plp³, third pleopod; Plp⁴, fourth pleopod; Plp⁵, fifth pleopod with enlarged view of apical, squamiferous protuberances.

specimens reveals their unquestioned presence. This is not the case in *Striella*. It should be pointed out, though, that some species related to *Exosphaeroma* are without folds (Menzies, 1954) and that Monod (1931) has warned against placing too much emphasis on the presence or absence of articulations.

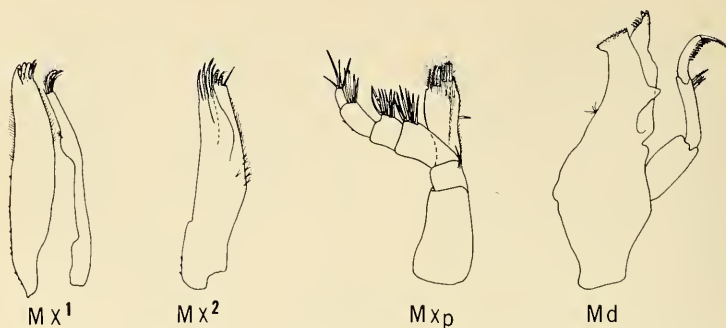


FIG. 9. *Striella balani* new genus, new species; Mx¹, first maxilla; Mx², second maxilla; Mxp, maxilliped; Md, mandible and mandibular palp.

Within the platybranchiates *Striella* satisfies all the characters of the Cassidinini except one, namely the proximal joints of Ant¹ are not expanded or easily viewed from above. Further, assignment to the genus *Cassidinidea* is not possible because the epistome does not protrude as a broad plate separating Ant¹, and the uropodal exopod is not greatly reduced in size.

Similarities with *Exosphaeroma* include at least the tenuiform, bifurcated penis; the inflated stylet; and the apical spine on the endopod of Plp¹. Except for the presence of respiratory folds and the dimorphic character of the pleotelson, Chilton's (1909) description of *Pseudo-sphaeroma* also shares much in common with *Striella*.

With the present and incomplete understanding of the relationships within the Sphaeromatidae, the proper assignment of transitional taxa like *Striella* is vexing. While it is here suggested that this species belongs to the platybranchiate line, one cannot dismiss the possibility of descent from the hemibranchiates with emphasis on development of an ovoid and depressed body structure.

Etymology: *balani*, from *balanos* (Gr.), because the first specimens were collected from large clusters of barnacles.

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